The Veliger 32(1):64–68 (January 3, 1989)

THE VELIGER

Opisthobranch Range Extensions in Alaska with the First Records of *Cuthona viridis* (Forbes, 1840) from the Pacific

by

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Abstract. The known ranges of 15 species of opisthobranch mollusks are extended northward to the vicinity of Ketchikan, Alaska. The presence of *Cuthona viridis* (Forbes, 1840) is recorded from the Pacific for the first time and an expanded species description is given.

The known ranges of opisthobranch mollusks occurring in Alaska have recently been summarized by LEE & FOSTER (1985). Since then, two additional species have been added, *Doridella steinbergae* (Lance, 1962) and *Hermaea vancouverensis* O'Donoghue, 1924 (FOSTER, 1987a, b). In June 1987, Sven Donaldson and I made a trip to Ketchikan, Alaska (55°25'N, 131°40'W). With the help of local divers, 10 dives were made, at six sites, all in the vicinity of Ketchikan (Figure 1). A total of 43 species of opisthobranchs were collected. The known ranges of 15 of these species are extended northward in this paper. The first Pacific records for *Cuthona viridis* (Forbes, 1840) are given, together with an expanded species description.

DESCRIPTION OF *Cuthona viridis*

Material: 3 June 1987, one specimen 8 mm long, 20 m below datum at Blank Island, Ketchikan, Alaska; 6 June 1987, one specimen 11 mm long, 5 m below datum at Clover Island, Ketchikan, Alaska; 7 June 1987, one specimen 11 mm long, 20 m below datum at Cutter Rock, Ketchikan, Alaska, deposited as a voucher specimen in the Royal British Columbia Museum, RBCM 988.24.1; 8 June 1988, 3 specimens, 6, 7.5 and 8 mm long, collected with spawn, 17 m below datum at Porlier Pass, Galiano Island, British Columbia (49°01'N, 123°36'W) on the hydroid *Sertularella* sp. All specimens were collected by the author on rocky substrates and length measurements are of live animals.

Anatomy: The living animal is moderately stout (Figure 2) and up to 11 mm in length. The body color is translucent white with opaque white ovotestis and oral glands, brown jaws, and black eyes visible through the skin. The oral tentacles taper and are slightly flattened dorsoventrally. They arise from the top anterolateral corners of the head. The smooth, cylindrical, tapering rhinophores are slightly longer than the oral tentacles. Both rhinophores and tentacles are encrusted with opaque white pigment dorsally. The head is subglobular with a T-shaped mouth opening.

The cerata are stout and slightly bulbous or cylindrical, with the tips abruptly forming a small point. Inside are large white cnidosacs. The liver diverticula are pale or dark olive green with darker granulations. The diverticula fill most of the interior of each ceras. The ceratal sheath is transparent. Each ceras bears opaque white pigment spots concentrated into two broken longitudinal lines on either side of its anterior face. The anterior face of each ceras is suffused with an opalescent orange blush of pigment which is more concentrated near the cnidosac base.

The cerata are arranged in distinct, almost vertical, rows borne on slight elevations. There are 4 or 5 pre-cardiac and 6 or 7 post-cardiac rows on either side of the animal, with up to 8 cerata per row. The short anteriormost row is a branch of the second row. The acleioproct anus is posterior in the interhepatic space, in front of the gap between the innermost two cerata of the first post-cardiac row. The gonopore is below and slightly posterior to the second or third ceratal row of the right anterior liver branch.

The foot is truncated, thickened anteriorly, and expanded slightly to form rounded corners. It has a small flange and ends in a short, bluntly pointed tail, which has an opaque white stripe in most specimens.

The uniserrate radula contains 45–58 teeth. The central cusp is equal in length to the first of the five or six denticles

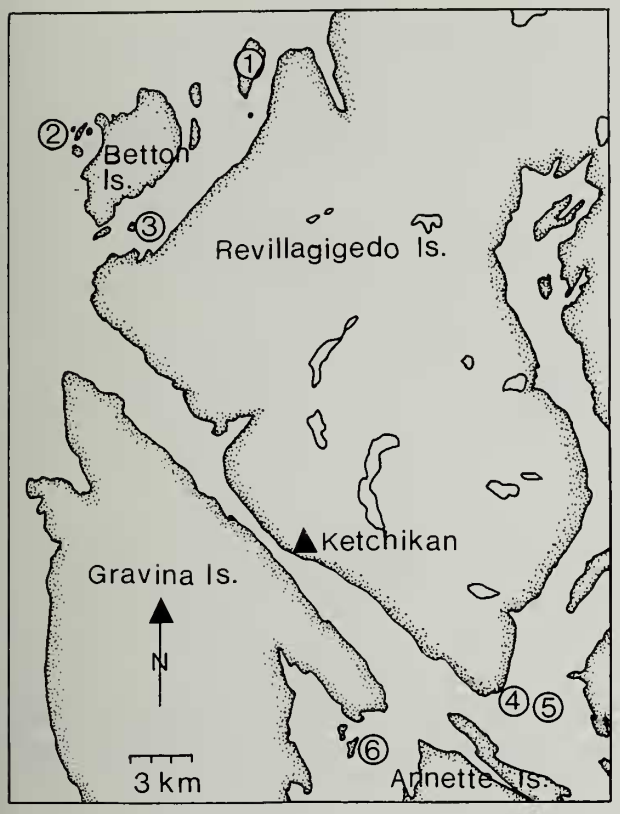

Figure 1

Map of Ketchikan, Alaska, showing collection sites: 1, Grant Island; 2, Tatoosh Islands; 3, Clover Island; 4, Mountain Point; 5, Cutter Rock; 6, Blank Islands.

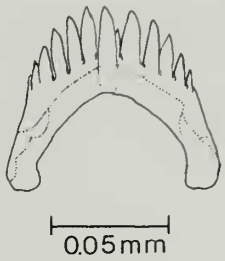

Figure 3

Radular tooth of *Cuthona viridis*.

on each side (Figure 3).There is sometimes a small intermediate denticle on one side of the central cusp. The width of the ribbon in an 8-mm specimen increased from 49 to 86 μm. In an 11-mm specimen the largest tooth was 98 μm wide and 86 μm high. The elongate jaws (Figure 4) have a large, delicate, masticatory flange, which has an irregular edge, but no obvious denticulations.

Small salivary glands are located on both sides of the esophagus. Large, straplike oral glands, with numerous short, fluffy white side branches, fill the anterior end of the animal.

In the reproductive system (Figure 5A), the ovotestis is connected by the preampullary duct to a kidney-shaped ampulla. The narrow postampullary duct branches to form a short oviduct, entering the female gland mass, and a narrow vas deferens. The vas deferens enlarges into a prostatic portion, folds back on itself and then curves and narrows into a non-prostatic portion, which enters the

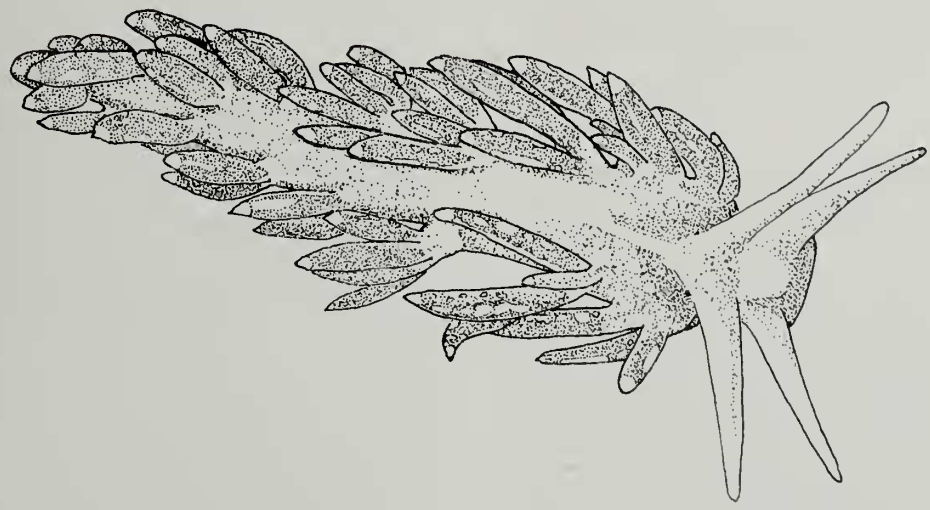

Figure 2

Cuthona viridis, drawn from a photograph of a live animal, 11 mm long.

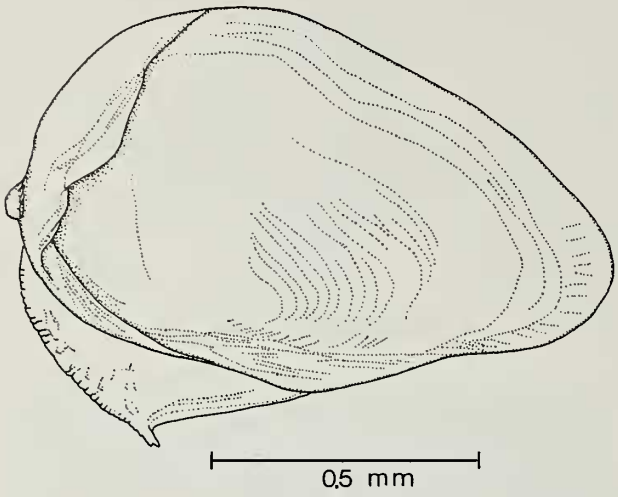

Figure 4

Jaw of *Cuthona viridis*.

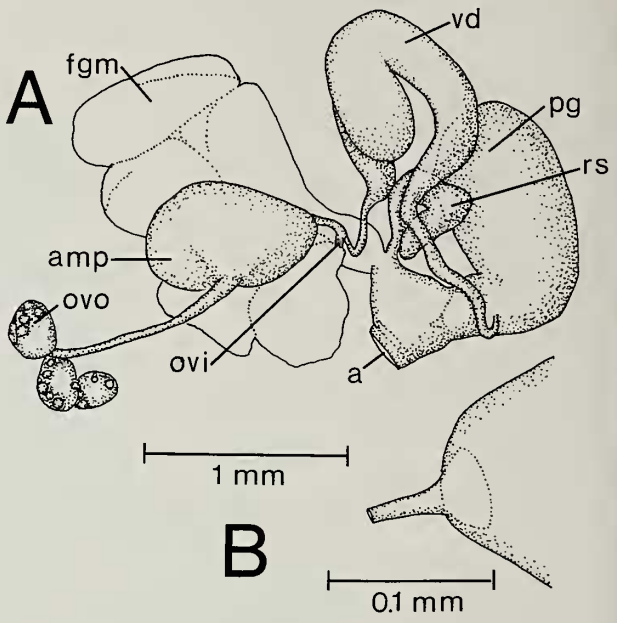

Figure 5

A. *Cuthona viridis* reproductive system from a camera lucida drawing. Key: a, common aperture; amp, ampulla; fgm, female gland mass; ovi, oviduct; ovo, ovotestis; pg, penial gland; rs, receptaculum seminis; vd, vas deferens. B. Penial stylet.

penial sac at the junction of the large, unstalked penial gland. The penis bears a golden-brown, straight, conical stylet (Figure 5B). There is an elongate, short-stalked receptaculum seminis, which is recurved, appearing as a spherical mass. It is located near the junction of the common genital atrium.

Spawn masses are upright ribbons, 1.5 mm high, laid in one and one-half coils. They contain capsules with a mean length of 171 μm, each with one white egg having a mean diameter of 134 μm.

RANGE EXTENSIONS

The following species are listed in alphabetical order with the new range marked by an asterisk. The changed northern range limit and its reference follow in parentheses.

Adalaria sp.—*Tatoosh Island, Ketchikan, Alaska to North Cove, Cape Arago, Oregon (British Columbia; MILLEN, 1987).

Ancula pacifica MacFarland, 1905—*Grant Island, Ketchikan, Alaska to Point Loma, San Diego, California (Bamfield, Vancouver Island, British Columbia; MILLEN, 1983).

Aplysiopsis smithi (Marcus, 1961)—*Cutter Rock, Ketchikan, Alaska to San Diego, California; Bahía de Los Angeles to Bahía de San Carlos, Gulf of California, Mexico (Crescent Beach, British Columbia; MILLEN, 1980).

Catriona columbiana (O'Donoghue, 1922)—*Cutter Rock, Ketchikan, Alaska to Mission Bay, San Diego, California; Japan; Capetown, South Africa (Pearse Island, British Columbia; LAMBERT, 1976).

Cuthona viridis (Forbes, 1840)—N.E. Pacific: *Blank Island, Ketchikan, Alaska to Porlier Pass, Galiano Island, British Columbia; Boreal amphi-Atlantic (first Pacific records).

Dendronotus diversicolor Robilliard, 1970—*Cutter Rock, Ketchikan, Alaska to Point Loma, San Diego, California (Porcher Island, British Columbia; LAMBERT, 1976).

Diaphorodoris lirulatocauda Millen, 1985—*Clover Island, Ketchikan, Alaska to Punta Banda, Baja California, Mexico (Juan Perez Sound, Queen Charlotte Islands; MILLEN, 1985).

Discodoris heathi MacFarland, 1905—*Cutter Rock, Ketchikan, Alaska to Bahía San Quentín, Baja California, Mexico (Porcher Island, British Columbia; LAMBERT, 1976).

Doto amyra Marcus, 1961—*Blank Island, Ketchikan, Alaska to Ensenada, Baja California, Mexico; Puerto Peñasco, Sonora, Mexico (Port Hardy, Vancouver Island, British Columbia; MILLEN, 1983).

Eubranchus olivaceus (O'Donoghue, 1922)—*Grant Island, Ketchikan, Alaska to Asilomar Beach, California; (Nuchatlitz Island, Esperanza Inlet, Vancouver Island, British Columbia; MILLEN, 1983).

Eubranchus rustyus (Marcus, 1961)—*Mountain Point, Ketchikan, Alaska to Punta Abreojos, Baja California, Mexico (Stubbs Island near Telegraph Cove, Vancouver Island, British Columbia; MILLEN, 1983).

Eubranchus sanjuanensis Roller, 1971—*Mountain Point, Ketchikan, Alaska to San Juan Island, Washington; northern New England (Porlier Pass, Galiano Island, British Columbia; MILLEN, 1983).

Flabellina pricei (MacFarland, 1966)—*Mountain

Point, Ketchikan, Alaska to La Jolla Canyon, San Diego, California (Pearse Island, British Columbia; LAMBERT, 1976).

Hallaxa chani Gosliner & Williams, 1975—*Grant Island, Ketchikan, Alaska to La Jolla, California (Earl's Cove, Agamemnon Channel, British Columbia; MILLEN, 1983).

Polycera (*Palio*) *zosterae* O'Donoghue, 1924—*Cutter Rock, Ketchikan, Alaska to Bodega Bay, California (Shushartie Bay, Vancouver Island, British Columbia; ROBILLIARD, 1971).

Stiliger fuscovittatus Lance, 1962—*Cutter Rock, Ketchikan, Alaska to San Diego, California; Bahía de los Angeles, Baja California, Mexico (Flat Top Islands, British Columbia; MILLEN, 1980).

DISCUSSION

This paper presents an expanded description of *Cuthona viridis* because it has not previously been recorded in the Pacific, and Pacific specimens differ in a few minor aspects from published accounts of Atlantic animals. Externally, the Alaskan specimens more closely resembled the drawing by Lemche in JUST & EDMUNDS (1985:pl. 59E–G) than the drawings by BROWN (1980:fig. 3I–K). Color differences are minor: the anterior ceratal faces had an orange rather than a yellow suffusion and the opaque white spots form two longitudinal streaks rather than one streak below a subapical ring as reported by THOMPSON & BROWN (1984). The cerata are distinctive in that they are stout compared with other tergipedids and have blunt ends, with wide cnidosacs and tiny, pointed tips. The cerata are borne on distinct, widely separated, almost vertical rows upon somewhat raised portions of the notum. The ceratal pattern is similar to that drawn by LEMCHE (1941:fig. 2). The row posterior to the anus did not fork as in the specimens drawn by ODHNER (1939:fig. 37).

The major internal difference is that the masticatory edge of the jaw is irregular but not denticulate. The reproductive system is as drawn by ODHNER (1939:fig. 40) except that the receptaculum seminis is a recurved tube rather than spherical and there is a common atrium. Both of these features are illustrated by LEMCHE (1941:fig. 2). There is a dark straight, conical penial stylet as mentioned by LEMCHE (1941) and BROWN (1980). The spawn mass is shorter but similiar in shape to that illustrated in KRESS (1971) and the eggs are the same size.

MILLER (1977), BROWN (1980) and THOMPSON & BROWN (1984) compare *Cuthona viridis* with *C. albocrusta* (MacFarland, 1966), *C. signifera* (Baba, 1961) and *C. scintillans* Miller, 1977. MILLER (1977) discussed several differences and it does not appear that these species are synonymous. The sympatric *C. albocrusta* differs externally in having more bluntly ended tentacles and rhinophores. The ceratal rows begin considerably farther behind the rhinophores, are more closely spaced, and are not raised. The cerata are more inflated and have smaller cnidosacs. The white encrustations on the cerata are not in the form of large white spots or streaks. Internally it differs in having narrower radular teeth with fewer denticles per side and possessing sharp denticulations on the jaw. The reproductive system has the vas deferens and penial sac joining the penis near its tip rather than its base, and has a curved as opposed to a straight penial stylet. The spawn mass is sausage-shaped, rather than the upright ribbon laid by *C. viridis*.

The presence of *Cuthona viridis* in the boreal northeastern Pacific and boreal amphi-Atlantic is not an uncommon pattern for opisthobranch mollusks. At present, 17 other opisthobranch species are known to share this type of distribution—which raises interesting questions. Are the populations discontinuous, or could there be gene flow through the Arctic, possibly during the summer, in El Niño years? If the populations are discontinuous, as low temperature and low salinity barriers suggest, how long have they been so, and why has speciation not taken place? A better understanding of geographical distributions may help to provide some answers.

ACKNOWLEDGMENTS

I thank the following people for their enthusiasm and assistance as diving partners in Ketchikan, Alaska: Sven Donaldson, Alan and Susan Murray, and Jack and Anne Robson. This research was funded by Dr. T. H. Carefoot's N.S.E.R.C. grant No. 585961.

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